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Engineering Library
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# Western Engineering

SAN FRANCISCO, DECEMBER, 1916

## This Issue Contains

Concrete Highway Construction in Contra Costa County, California

The Maintenance of Roads

Timber-Framing

Diagram for Computing Result of Suspending Operations on an Oil-Property

Sinking Through Sand

Sewage-Disposal Methods in Several American Cities

Engineers for the Officers' Reserve Corps

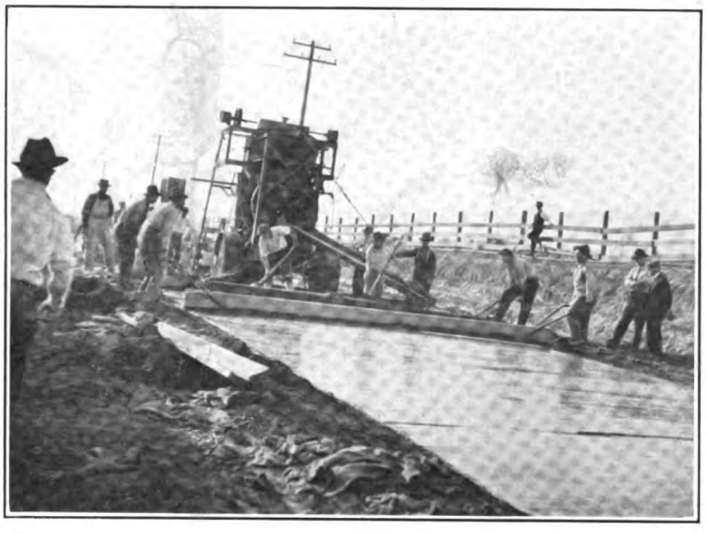
Methods and Costs of Construction of Part of Winnipeg Aqueduct

Effect of the Oregon Water Code Decision Upon Codes of Other States

Proposed Harbor Improvements at Newport Beach, California

Methods of Construction of 200-Foot Reinforced Concrete Chimney at Agnew, California

*News Bulletin End of Reading Section*



CONCRETE HIGHWAYS in Contra Costa County have a thicker pavement and a richer mixture than is customary in other parts of California. No asphaltic carpet or other surfacing material is used and the surface is corrugated, making it non-skidding. A description appears in this number.

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*For the Biggest Office Building west of Chicago*

# Santa Cruz Portland Cement

*has been selected*

NEW OFFICE BUILDING FOR THE SOUTHERN PACIFIC COMPANY, SAN FRANCISCO
(NOW UNDER CONSTRUCTION)

BLISS & FAVILLE, Architects LINDGREN CO., Contractors
HEALY-TIBBITTS CONSTRUCTION CO., Excavation and Foundation

*"Concrete for Permanence"*

## Santa Cruz Portland Cement Co.

**Crocker Building** **San Francisco**

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# Westinghouse

## Electrically Operated Equipment

## Solving the Power Problem For Engineers and Contractors

Ten years ago you might have been justified in setting aside the suggestion of an electrically-driven plant as impracticable.

Five years ago careful investigation possibly showed that electric drive—in spite of its advantages—cost too much.

Today you find few jobs without some electrically-driven equipment and many jobs are electrically-driven throughout. Some of these are big construction works, others are small contracts.

The primary reason for this change is ECONOMY, CONVENIENCE follows a close second. The assurance of CONTINUOUS OPERATION is a third factor which appeals to the present-day contractor.

Westinghouse Motors and Control are practically fool proof. They are designed and built to meet the severe requirements of contractors' service with minimum expense for operation and maintenance. Their use is your best assurance of continuous and efficient operation.

Westinghouse Engineers are ready to consult with contractors upon this important subject of POWER. They will aid you or your engineers in the development of economical plant layouts. They will tell you whether—or not—Westinghouse drive will effect economy upon your work.

**Westinghouse Electric & Manufacturing Co.**
**East Pittsburgh, Pa.**

W
WESTINGHOUSE ELECTRIC

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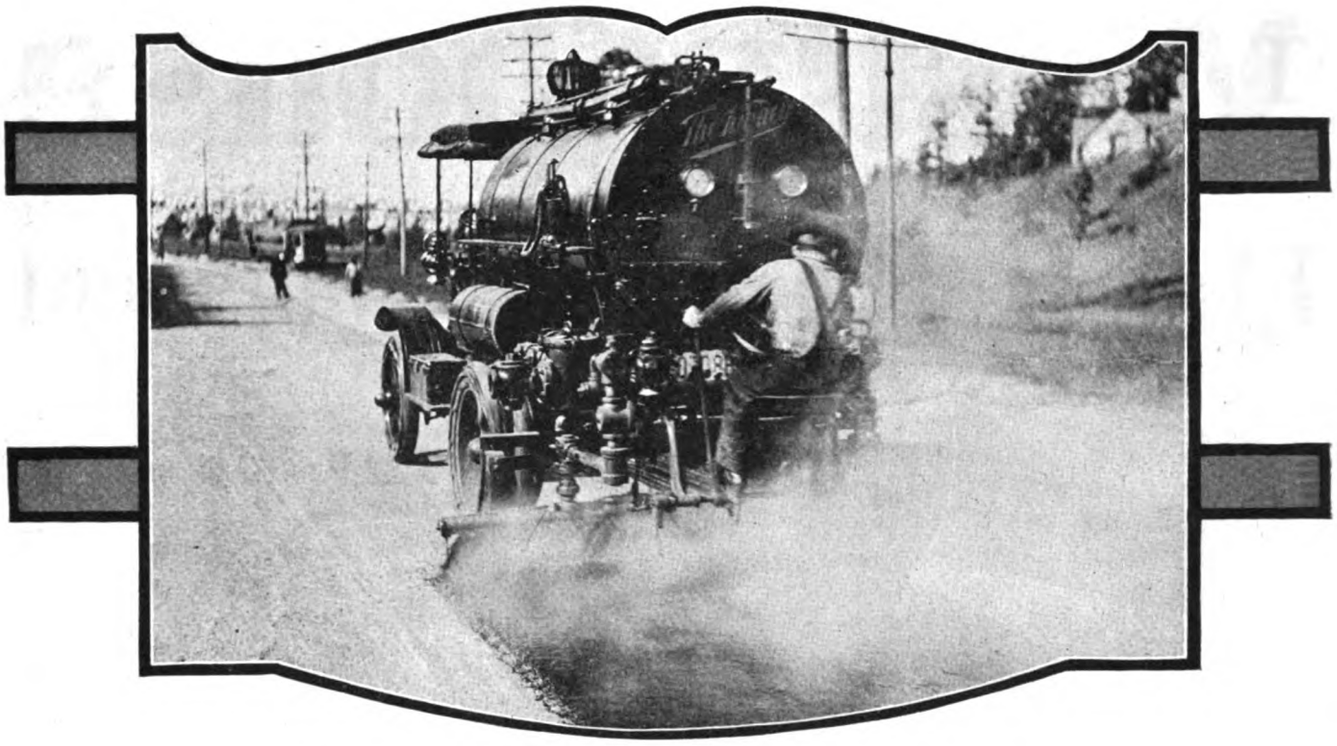

*Power pressure sprinkler for the application of "E" grade asphaltum by the penetration method. The tank is equipped with heating devices to keep the asphaltum hot while in transit.*

# "E" grade Asphaltum has displaced road oils

## as it is a better binding and waterproofing agent

Under similar conditions in an Impact Test, a testing briquet made with 90% rock dust and 10% "**E**" **grade asphaltum** will stand approximately 5000 blows as against 1000 blows for a testing briquet made with 90% rock dust and 10% **road oil** containing **90% asphaltum.**

Under Compression the "**E**" **grade asphaltum** briquet will crush at about 700 lbs. per square inch, while under similar conditions the **road oil** briquet will crush at about 300 lbs. per square inch.

A road made with "**E**" **grade asphaltum** will "set up" more quickly than a road made with **road oil.**

# CALOL ASPHALTUM

## "E" grade

is run to a positive specified standard, insuring perfect uniformity and best possible results.

Shipped in tank cars equipped with steam coils for unloading purposes, and also in wood barrels.

**Write for particulars and prices.**

# STANDARD OIL COMPANY

**STANDARD OIL BUILDING** (CALIFORNIA) **SAN FRANCISCO**

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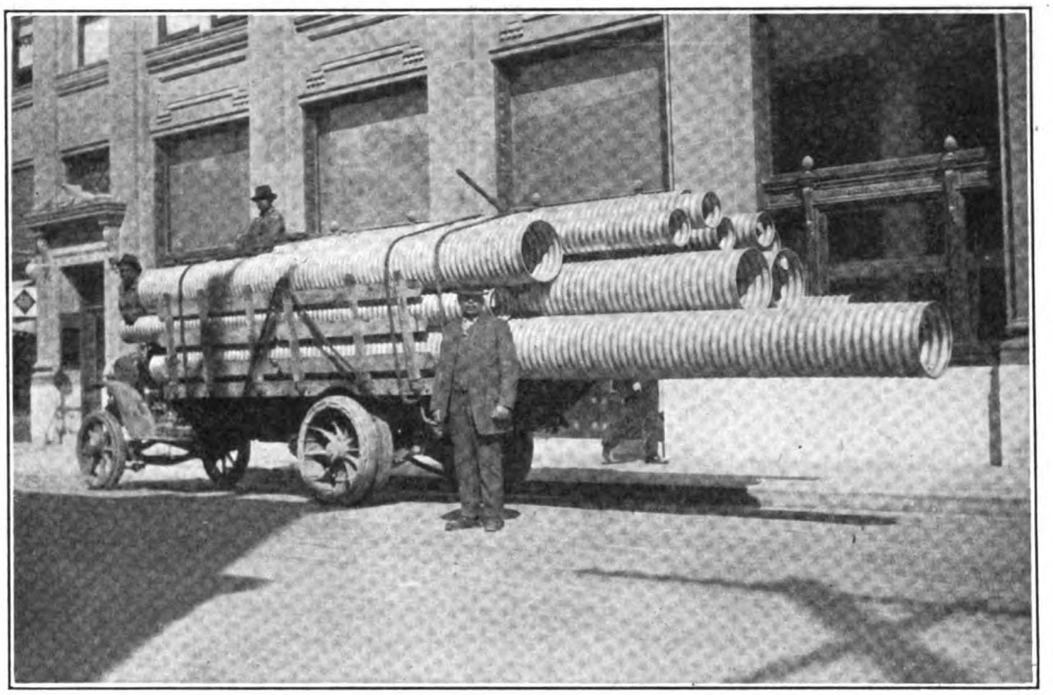
# Twentieth Century Efficiency
## Applied to the Culvert Problem



Seventy-five hundred pounds of "Armco" Iron Culverts loaded on a White Truck. The trip, including loading, unloading and return, was made in 3½ hours. The distance covered was fourteen miles, with several 15% grades. The total cost of delivery, including loading and unloading, was five dollars.

Installation was a short and simple matter. Where "Armco" Iron Culverts are employed, the ditch is often opened and filled on the same day and the road re-opened for traffic. Common labor and common sense are the necessary factors.

The best thing about these culverts, however, is their Lasting Quality. Their material is the purest and most carefully made of commercial irons, and affords lifetime service. This is "The Iron That's Made to Last."

For full information as to Rust-Resisting "Armco" (American Ingot) Iron Culverts, Siphons, Flumes, Sheets, Plates, Roofing and Formed Products, write the Nearest Manufacturer.

AMERICAN ARMCO INGOT IRON
Resists Rust

**California**—Los Angeles and West Berkeley
California Corrugated Culvert Company

**Colorado**—Denver
R. Hardesty Mfg. Company

**Montana**—Missoula
Montana Corrugated Culvert & Flume Co.

**Nebraska**—Wahoo
Nebraska Culvert & Mfg. Co.

**Ohio**—Middletown
The American Rolling Mill Co.

**Oregon**—Portland
Coast Culvert & Flume Company

**South Dakota**—Sioux Falls
Sioux Falls Metal Culvert Co.

**Texas**—El Paso
Western Metal Mfg. Company

**Texas**—Houston
Lone Star Culvert Co.

**Utah**—Woods Cross
Utah Corrugated Culvert & Flume Co.

**Washington**—Spokane
Spokane Corrugated Culvert & Tank Co.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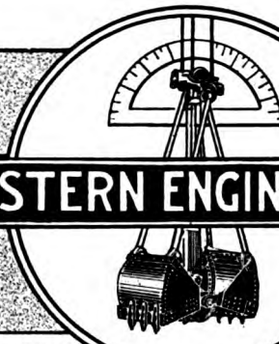
BUYER  SELLER

WESTERN ENGINEERING

THE CONNECTING LINK

To Our Readers and Friends:

In this, the last issue of the present year, we wish you

A MERRY CHRISTMAS

and a

HAPPY, PROSPEROUS NEW YEAR

WESTERN ENGINEERING PUBLISHING COMPANY

Western Engineering Publishing Company
420 Market St., - San Francisco.

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**Be "Prepared" to Handle Your Next Job**

Check article on which you desire information.

| | |
|---|---|
| | Wheelbarrows: Wooden; Steel Tray; Concrete. |
| | Scrapers: Drag and Wheeled. |
| | Carts: Contractor's. |

**The Kilbourne & Jacobs Mfg. Co.**

Columbus, Ohio, U. S. A.

New York: 25 Broad St. London, E. C.

CUT OUT AND RETURN TO US

ENGINEERS AND BUILDERS OF

**EASTWOOD MULTIPLE ARCHED DAMS**

New Big Bear Valley Dam, California

**EASTWOOD CONSTRUCTION CO.**

1020-1-2 Hearst Building SAN FRANCISCO

**Sacramento Pipe Works**

MANUFACTURERS

SHEET STEEL RIVETED PIPE
WELL CASING and AIR PIPE

WHOLESALE DISTRIBUTORS

Standard Pipe Screw Joint Casing
Pipe and Casing Fittings Valves and Brass Goods

Hydraulic Engineers and Contractors

SACRAMENTO, CAL.

**TROJAN EXPLOSIVES**

The Most Powerful Made
Safe and Economical

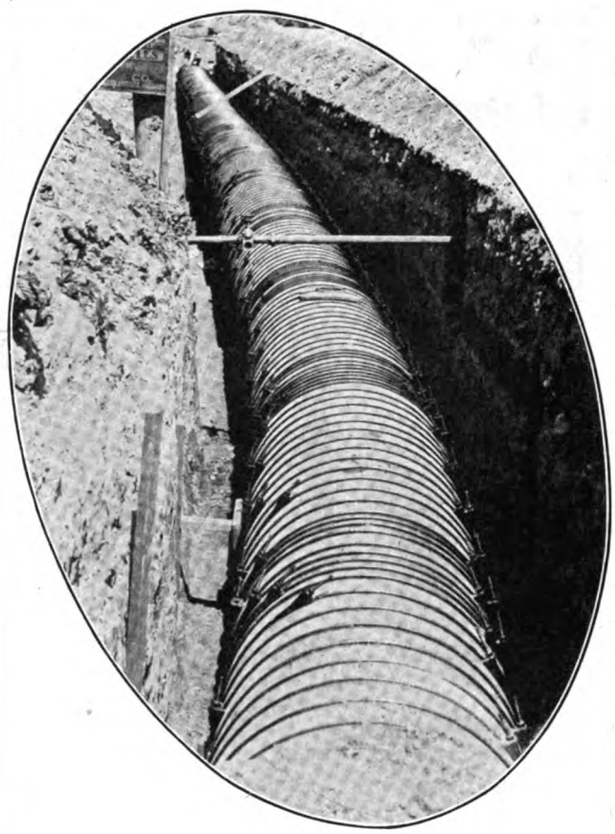
Manufactured on a solid base and do not contain any liquid explosive ingredient.

Will not freeze Will not exude
Will not give off noxious gases

No thawing
No leaking
No headaches

California Trojan Powder Company

Phelan Building, San Francisco, Cal.
Railway Exchange Bdg., Portland, Oregon



**Pacific Wood Stave Pipe**

*selected in Southern California*

This city water system main line required pipe with high carrying capacity, low first cost and durability.

The Engineers selected Pacific Wood Stave Pipe because it filled the requirements. Pacific Wood Stave Pipe has

**20 Per Cent Greater Carrying Power**

than riveted steel pipe. It *maintains* this greater power because the interior surface does not become fouled with tubercles or moss.

*Pacific Wood Stave Pipe is low in first cost and easy to handle. It lasts.*

Read the whole interesting story—"Wooden Pipe: Its Many Advantages." A copy sent on request.

**Pacific Tank and Pipe Company**

300 Market Street, San Francisco
901 Trust and Savings Bank Building, Los Angeles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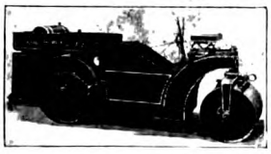
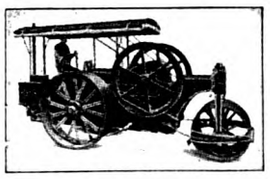
# AUSTIN WESTERN ROAD MACHINERY



Tandem Roller

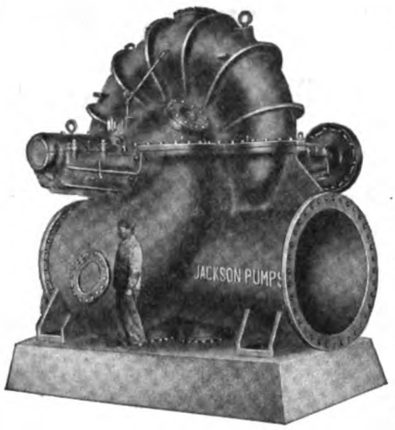
Tandem and Macadam Rollers
Road and Elevating Graders
Jaw and Gyratory Crushers
Street Sprinklers and Sweepers
Dump and Spreader Wagons
Austin Pressure Road Oilers



Macadam Roller

EARTH-HANDLING EQUIPMENT OF ALL KINDS

**The Austin-Western Road Machinery Co.**
NEW YORK CHICAGO
SAN FRANCISCO OFFICE 23 Fremont Street
PORTLAND, OREGON, AGTS. Hodson Feenaughty Co.
LOS ANGELES OFFICE 120 Los Angeles St.




Centrifugal AND Turbine Pumps
FOR
IRRIGATION
RECLAMATION
MINES
WATER WORKS
BOILER FEED
SUGAR MILLS
SAND AND GRAVEL

Capacities: 10 to 100,000 gallons per minute, any head.

We shall be more than pleased to furnish preliminary estimates for any type of pumping plant.

**BYRON JACKSON IRON WORKS, Inc.**
SAN FRANCISCO
*Write for Catalogue No. 30*

# "Grant Concrete Mix"

The only properly proportioned mix in this market. Composed of hard, clean, fresh-water gravel, free from sandstone, and contains about 25% of crushed rock and necessary amount of sand.

We Guarantee Less Than 25% Voids

Used on many important first-class buildings and road work. Accepted on all City, State and U. S. Government work.

**Grant Gravel Company**
Flatiron Bldg. Phone Sutter 1582
SAN FRANCISCO

**Reinforcing bars cut to length, fabricated or placed.**

**Steel Castings.**

**Wrought Iron or Steel Pipe.**

**Lock Bar Pipe, sizes 20″ to 72″ diameter.**

**Suction Dredges.**

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*Cement-Concrete Construction*

**"Asphalt Concrete"**
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We are dealers in Asphalt, Lime Dust, Rock and Sand.

**Worswick Street Paving Company**
Union National Bank Building, FRESNO, CAL.

J. P. SHERBESMAN

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STEAM SHOVEL
COMPANY

CONTRACTORS' EQUIPMENTS
SOLD—RENTED—EXCHANGED

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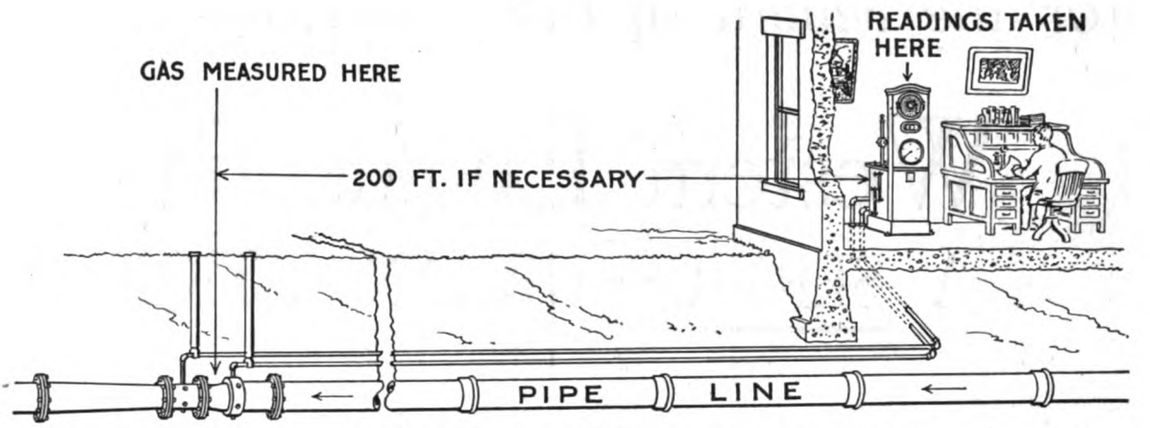



## One Advantage of the Venturi Meter for Gas Measurement

As shown by the sketch above, the registering instrument of the Venturi Gas Meter can usually be placed where readings can be taken with the greatest possible convenience.

This feature of the Venturi Gas Meter frequently means the saving of time, and "time saved is money earned."

Other engineering advantages of the Venturi Gas Meter, involving the saving of many dollars, are described in our new 51-page Bulletin No. 86-C. This Bulletin also contains an account of tests which have demonstrated the accuracy of the Venturi Gas Meter. *Write for your copy today.*

**BUILDERS IRON FOUNDRY, "Builders of the Venturi," PROVIDENCE, R. I.**

*Agents:* **Norman B. Livermore, San Francisco.**
**Northwestern Equipment Co., Portland. Seattle.**

## Features That Count For Superiority in Mine Pumps

It is not only the highest development of the centrifugal principle of pumping that makes "American" centrifugals excel as mine pumps, but the development of special balanced types with grit-proof bearings which enables them to be installed in any location and operate successfully under the most difficult pumping conditions.

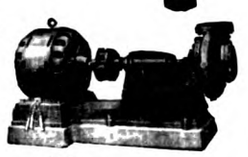
Several new types of sinker, inclined shaft and station pumps represent advanced practice in mine pump design you should know about.

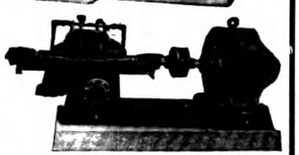
Catalog 132 describes them.
Write for your copy.

**THE AMERICAN WELL WORKS**

**General Office and Works**
**Aurora, Ill.**

**Chicago Office**
**First National Bank Building.**





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California Hydraulic Eng. & Supply Co., 74 Fremont St., San Francisco.
American Pump Co., Los Angeles.
Salt Lake Hardware Co., Salt Lake City.
M. J. O'Fallon Supply Co., Denver

## A perfect trench at one cut

and variable width trenches with a single wheel are the big features offered for a quarter of a century in the

## Buckeye Ditcher

**(Traction Drive)**

Send for the catalog which tells in detail how they are made, why they stand the wear and tear, and shows photos of many machines at work.

We would like to tell you about repeat orders from California users.

The Buckeye Traction Ditcher Co., Findlay, Ohio, makes a full line of traction tile, and open ditchers, trench and pipe-line excavators, clay and peat diggers.

Where would you like the catalog sent?

**A. L. YOUNG MACHINERY COMPANY**
**26-28 FREMONT ST., SAN FRANCISCO**


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*For the benefit of our readers—*

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ENGINEERING MAGAZINES of today are more than "just magazines." They render definite service outside of the printed page.

WESTERN ENGINEERING is a *Service* organization for the convenience of any who may wish to use it. We are glad to be of help to any of our readers, whether in supplying information or in buying or selling equipment.

If you are looking for certain equipment or want prices on materials or machinery, we will get the information for you. We have catalogs of all kinds of construction equipment and are in personal touch with many of the mercantile houses.

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If you are looking for certain men, or in need of information, we will undertake to supply you.

There is no charge for this service. It is part of our duty in publishing a technical magazine.

Just write or phone and LET US RENDER YOU SERVICE.

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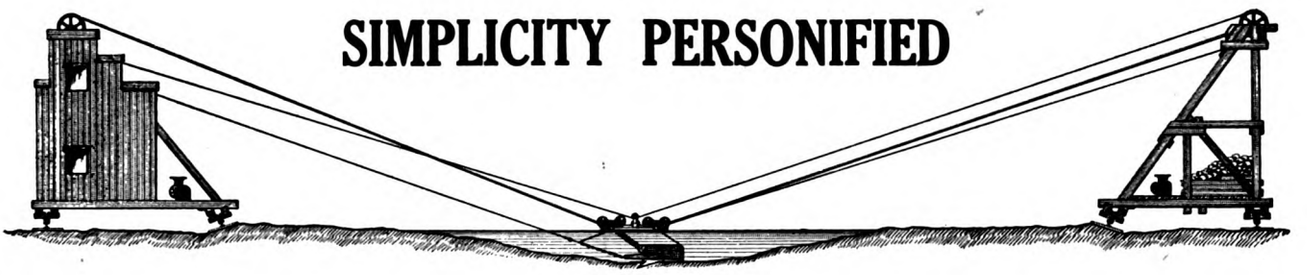

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That will be your first thought when you see a

## Hadsel Patent Slack-Cable Excavator

in operation

**YOU WILL SEE**

That it digs as readily under water as on the surface;

That its speed of operation is astonishing;

That it has a wide range of operation without moving either terminal;

That an unusually long span between terminals is maintained with ease;

That the absence of operatives around the work is a matter of wonderment;

That you have to hunt to find the one man that controls its entire operation.

You will satisfy yourself that in very truth it solves absolutely the problem of cheap operating cost.

Not only that, but perhaps the most pleasing feature of all, is the

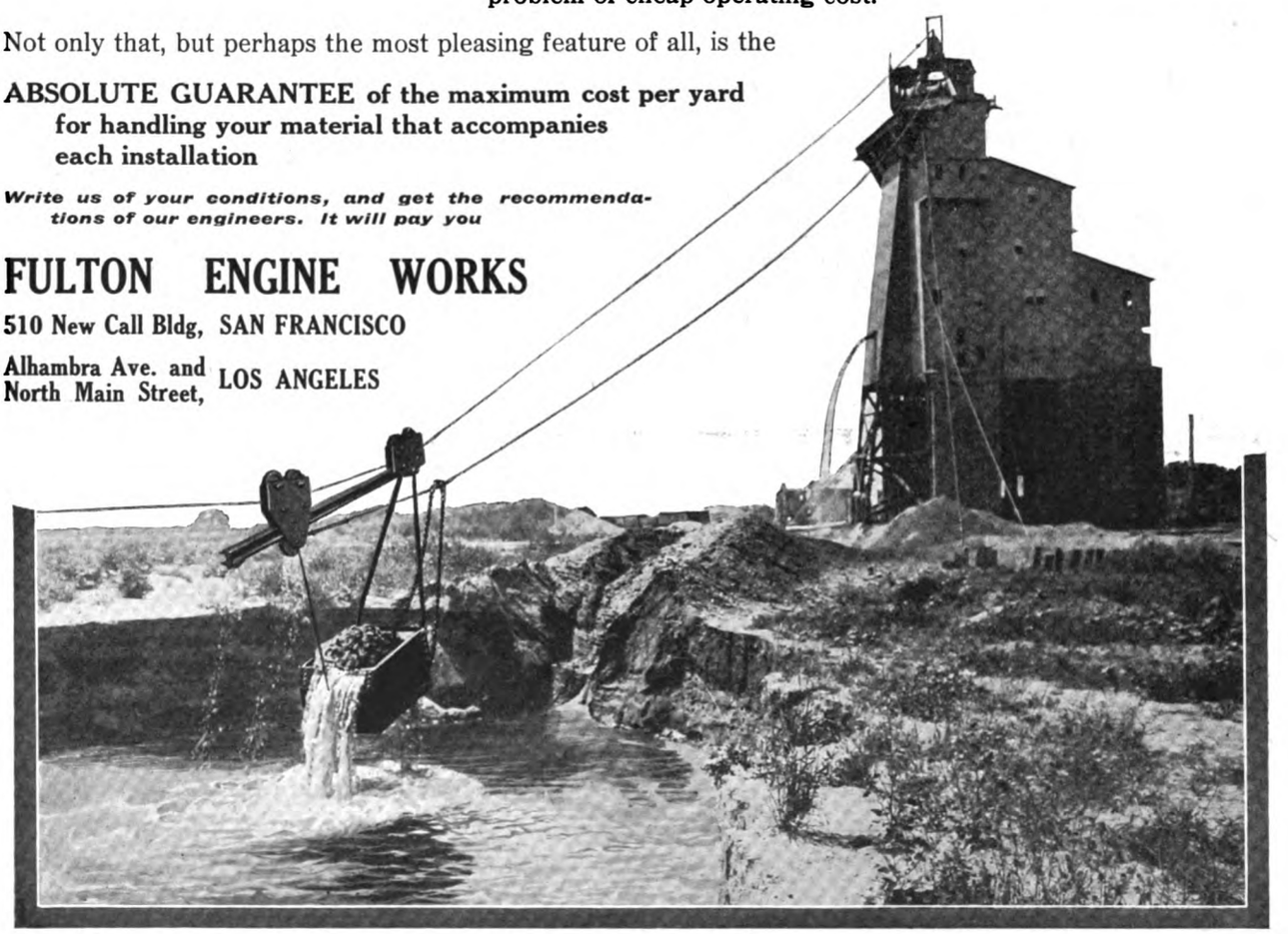
**ABSOLUTE GUARANTEE of the maximum cost per yard for handling your material that accompanies each installation**

***Write us of your conditions, and get the recommendations of our engineers. It will pay you***

**FULTON ENGINE WORKS**

**510 New Call Bldg, SAN FRANCISCO**

**Alhambra Ave. and North Main Street, LOS ANGELES**

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# STEEL PERMANENCY PAYS

The Permanency of Steel and its continued "liveness" during service are outstanding important factors. More engineers every year are realizing that Steel Permanency Pays—that the first cost of steel is its only cost and that it SERVES BEST.

Steel installations justify. Steel work of all kinds keeps as live as a spring throughout its use. Steel has the strength and durability to stand hard usage without a failure.

**WESTERN** Steel Has One More Point in its Favor—

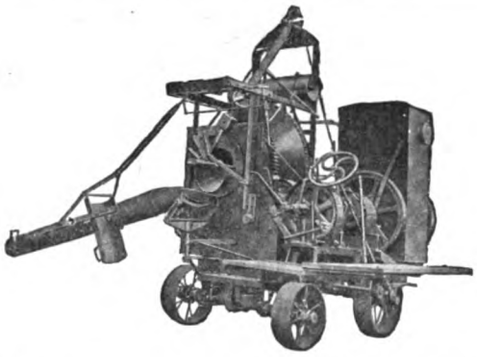
It has the surety factor, "Western Service." "Western Service" is your absolute guarantee. Our engineering department must approve every piece of construction before it is put through the factory. They must be satisfied that the material ordered is what you should have before it goes out. Each installation is inspected after completion, to make doubly sure that Western is serving you properly.

*Write for our Bulletins*

## WESTERN PIPE & STEEL COMPANY
**OF CALIFORNIA**

444 Market Street, San Francisco — 1758 N. Broadway, Los Angeles

BRANCH OFFICES:
Bakersfield Taft Fresno Stockton Sacramento



## "A Foote for Profits"

In figuring your year's profit you'll find the most profitable piece of equipment to be your Foote Paver. No other machine can stand up and deliver such large capacities with so little expense. Ask any user about it.

**FOOTE MFG. CO., Nunda, N. Y.**
Represented by
**EDWARD R. BACON COMPANY**
51 Minna St., San Francisco
350 Merrick St., Los Angeles

## Troy-Ajax

You have seen some wagons get stalled when the load is dumped on account of the doors digging into the pile—well, the loop hinges on the Troy-Ajax allow the doors to raise and slide over the pile. That's one big advantage the Troy-Ajax has over all other wagons. Notice the doors raised in the illustration.

**The Troy Wagon Works Company**
Troy, Miami County, Ohio.
*Represented by*
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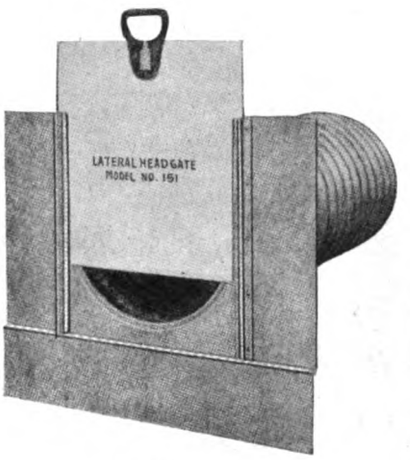
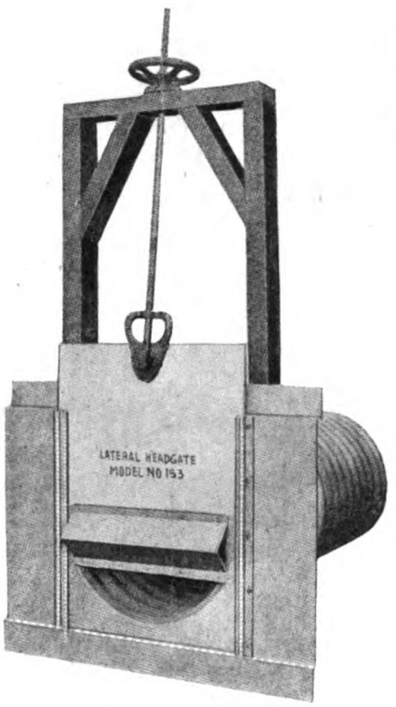
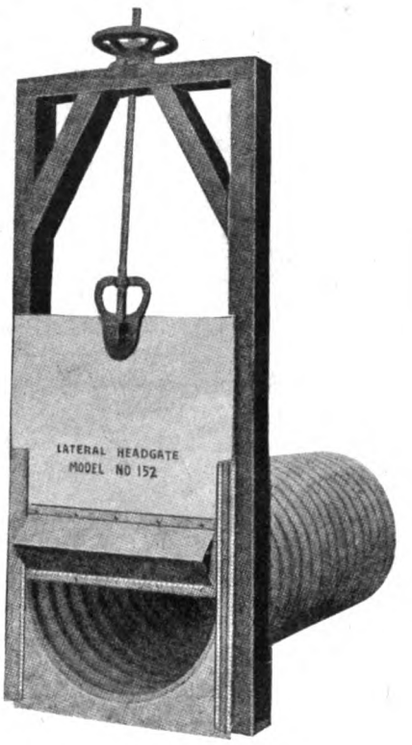



Model No. 151




Model No. 153

**Three of our representative models**




Model No. 152

# AMERICAN IRRIGATION GATES

manufactured from **copper-alloy** material, are permanent in the severest kind of service, because they are **rust-resisting** and **non-corrosive.**

American Gates and Corrugated Pipe are **guaranteed for 25 years in service.** They are less expensive and easier to install than concrete. They have the lasting quality that gives long-time satisfaction.

Made in diameters of 8″ to 36″. Write for descriptive catalog and prices.

## AMERICAN CORRUGATED CULVERT COMPANY

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# Western Engineering

CHARLES T. HUTCHINSON, Managing Editor
A. T. PARSONS, Associate Editor
C. H. TALLANT, Advertising Manager

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VOL. 7 NO. 12 SAN FRANCISCO, DECEMBER, 1916



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THE MAINTENANCE OF ROADS.
By *William F. Cocke.* *Page* 452

Discusses the maintenance of roads by patrolmen who cover the roads nearly every day, and by gangs which cover the roads several times during the year. The place of both systems in a complete system of maintenance is shown. **Western Engineering,** December 1916.

CONCRETE HIGHWAY CONSTRUCTION IN CONTRA COSTA COUNTY, CALIFORNIA. *Page* 453

Eleven miles of concrete highway is being constructed each year by the county, funds being provided from the general tax-levy. The concrete is 5 in. thick and there is no asphaltic surface. It is finished with a corrugated surface to prevent skidding. **Western Engineering,** December 1916. Illustrated.

TIMBER-FRAMING. PART VII.
By *Henry D. Dewell.* *Page* 455

This article of Mr. Dewell's series discusses the complete design of timber trusses, both of the simple and the lattice type. **Western Engineering,** December 1916. Illustrated.

DIAGRAM FOR COMPUTING RESULT OF SUSPENDING OPERATIONS ON AN OIL-PROPERTY.
By *Thomas Cox.* *Page* 462

The diagram shows the decline in present value of an oil-property caused by suspending operations for a period of years and also the price per barrel at the end of the period necessary to compensate for the 'shut-down.' **Western Engineering,** December 1916. Illustrated.

SINKING THROUGH SAND.
By *Edward A. Sayre.* *Page* 463

As a result of actual experience the 'drop-shaft' method is shown to be superior to the 'steel-shoe' method. **Western Engineering,** December 1916. Illustrated.

SEWAGE-DISPOSAL METHODS IN SEVERAL AMERICAN CITIES.
By *T. D. Allin and R. V. Orbison.* *Page* 465

The authors recently made an inspection trip through the East and Middle West, visiting a number of cities. Imhoff tanks, followed by filtration and sludge-beds and in some cases by secondary tanks, appear to give the best results, with the exception of activated sludge. The latter process has passed the experimental stage, and it is possible that it will supplant the older processes. **Western Engineering,** December 1916. Illustrated.

ENGINEERS FOR THE OFFICERS' RESERVE CORPS.
By *A. H. Babcock.* *Page* 469

Discusses the different branches of the service in the newly-established reserve corps that offer the greatest field of usefulness to engineers, and shows that there is an opportunity for the exercise of the abilities of practically every engineer. **Western Engineering,** December 1916.

METHODS AND COSTS OF CONSTRUCTION OF PART OF WINNIPEG AQUEDUCT. By *H. L. Tilley.* *Page* 473

A drag-line excavator is used for digging the trench, which is 3½ ft. deep on an average. Concrete is delivered from the mixer to the forms by means of an industrial railroad, the maximum haul being ½ mile. **Western Engineering,** December 1916. Illustrated

THE EFFECT OF THE OREGON WATER CODE DECISION UPON CODES OF OTHER STATES.
By *Percy A. Cupper.* *Page* 475

Discusses the decision of the United States Supreme Court upholding the Oregon Water Code. **Western Engineering,** December 1916.

LIGHT-WEIGHT CARS FOR ELECTRIC RAILWAYS. *Page* 475

These cars are usually operated by one man and are used on light-traffic lines. **Western Engineering,** December 1916.

PROPOSED HARBOR IMPROVEMENTS AT NEWPORT BEACH, CALIFORNIA. *Page* 476

These improvements include dredging and the construction of a jetty, as well as some less important work. Bonds for the construction of the jetty have already been voted. **Western Engineering,** December 1916. Illustrated.

METHODS OF CONSTRUCTION OF 200-FT. REINFORCED CONCRETE CHIMNEY AT AGNEW, CALIFORNIA. *Page* 477

This 200-ft. chimney was constructed on quicksand. It was built for a company which distills alcohol from waste molasses. **Western Engineering,** December 1916. Illustrated.

HOW TO STORE CEMENT. *Page* 478

Air and water should be kept from stored cement as much as possible. **Western Engineering,** December 1916.

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Chart for Correcting Steel Tapes for Sag, Stretch, and Temperature. By Walter Scott Weeks.

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A New Model Little Tugger Hoist.

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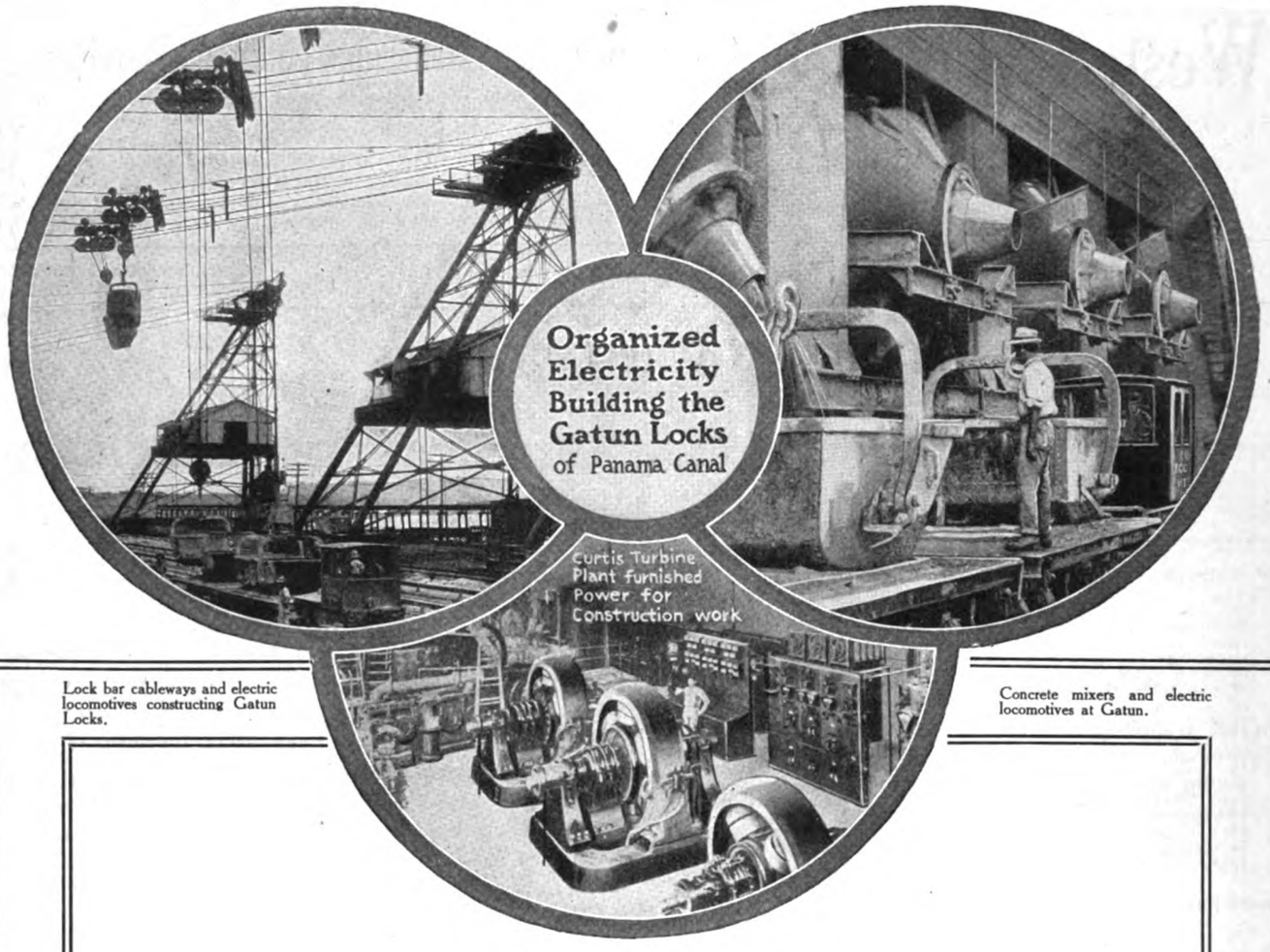


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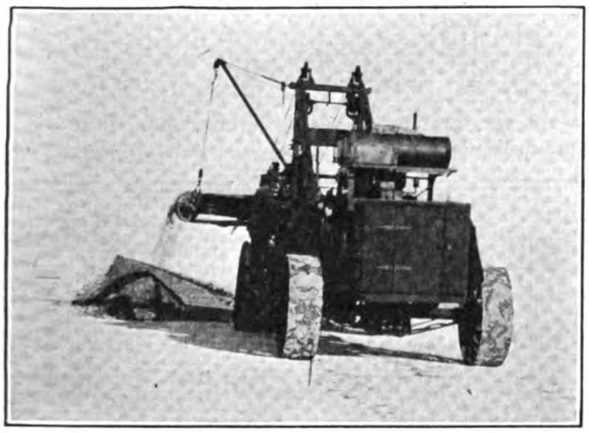

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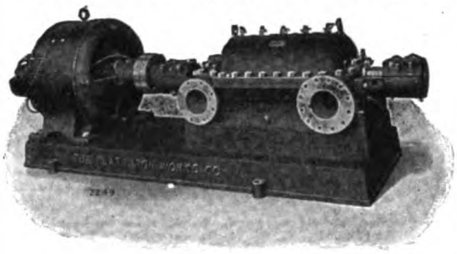

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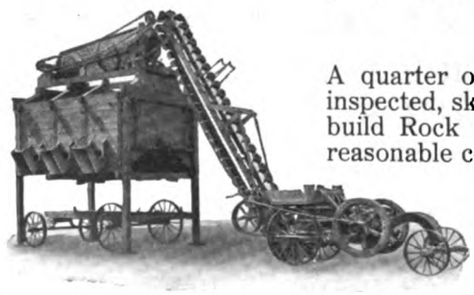

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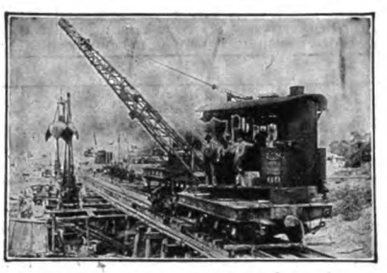

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Standard Oil Co.
Worswick Street Paving Co.

**ASPHALT PLANTS**
Austin-Western Road Machy. Co.
Bacon & Co., Edward R.
Kinney Manufacturing Co.
Young Machy. Co., A. L.

**AUTO TRUCKS**
Kinney Manufacturing Co.
Tiffin Wagon Co., The.

**BELTING**
N. Y. Belting & Packing Co.

**BLASTING SUPPLIES**
Cal. Trojan Powder Co.

**BLOWERS**
Allis-Chalmers Mfg. Co.
General Electric Co.

**BOILERS**
Allis-Chalmers Mfg. Co.
Moore & Co., Chas. C., Engineers.

**BONDS, CONTRACTORS**
Aetna Accident & Liability Co.

**BOOKS, TECHNICAL**
Mining and Scientific Press.

**BRIQUETTING MACHINERY**
Meese & Gottfried Company.

**BRUSHES, MOTOR, AND GENERATOR**
General Electric Co.
Westinghouse Electric & Mfg. Co.

**BUCKETS**
Allis-Chalmers Mfg. Co.
Meese & Gottfried Company.

**BUCKETS, CONCRETE**
Kilbourne & Jacobs Mfg. Co.

**CABLE**
Roebling's Sons, Co., John A.

**CABLEWAYS, SUSPENSION**
Roebling's Sons Co., John A.

**CARRIERS**
Browning Co., The.

**CARS, CONTRACTORS'**
Kilbourne & Jacobs Mfg. Co.

**CARS, DUMP**
Kilbourne & Jacobs Mfg. Co.

**CARTS, CONCRETE**
Kilbourne & Jacobs Mfg. Co.

**CEMENT GUNS**
Chalmers, Inc., H. A.

**CEMENT, PORTLAND**
Cowell Lime & Cement Co., Henry.
Pacific Portland Cement Co., Con.
Santa Cruz Portland Cement Co.

**CHAIN**
Meese & Gottfried Company.

**CHAINS, TRANSMISSION**
(See 'Transmission Machy.')

**CLUTCHES, FRICTION**
Meese & Gottfried Company.

**COAL**
Allen, Chas. R.

**COAL HANDLING MACHINERY**
Good Roads Machy. Co., Inc., The.
Meese & Gottfried Company.

**COMPRESSORS, AIR**
Allis-Chalmers Mfg. Co.
Moore & Co., Chas. C., Engineers.
Platt Iron Works Co.

**CONCRETE MIXERS**
Bacon & Co., Edward R.
Enterprise Electric Works.
Foote Mfg. Co.
Good Roads Machy. Co., Inc., The.
Jaeger Machine Co.
Rapid Heated Mixer Co.
Smith Co., T. L.
Waterloo Cement Machy. Corp.
Young Machy. Co., A. L.

**CONDENSERS**
Allis-Chalmers Mfg. Co.
General Electric Co.

**CONTRACTORS, GENERAL**
Chalmers, Inc., H. A.
Daniel Contracting Co.
Eastwood Construction Co.
Fairchild-Gilmore-Wilton Co.
McClenahan-Kraner-Carter Co.
Rolandi, F.
Twohy Bros. Co.
Ware, R. F.
Worswick Street Paving Co.

**CONTRACTORS' MACHINERY**
Austin-Western Road Machy. Co.
Bacon & Co., Edward R.
Browning Co., The.
Enterprise Electric Works.
Good Roads Machy. Co., Inc., The.
Jackson Iron Works, Byron.
Kilbourne & Jacobs Mfg. Co.
Kinney Manufacturing Co.
Platt Iron Works Co.
Smith Co., T. L.
Waterloo Cement Machy. Corp.
Young Machy. Co., A. L.

**CRANES**
Bacon & Co., Edward R.
Browning Co., The.
Osgood Co., The.

**CRUSHERS**
Austin-Western Road Machy. Co.
Allis-Chalmers Mfg. Co.
Bacon & Co., Edward R.
Good Roads Machy. Co., Inc., The.
Meese & Gottfried Company.

**CULVERTS, CORRUGATED**
American Corrugated Culvert Co.
Armco Iron Culvert & Flume Mfgrs. Assoc.
California Corrugated Culvert Co.
Coast Culvert & Flume Co.
Corrugated Culvert Companies.
Nevada Metal Mfg. Co.
Spokane Corrugated Culvert & Tank Co.
Western Pipe & Steel Co.

**DAM CONSTRUCTION**
Eastwood Construction Co.

**DITCH DIGGERS**
Bacon & Co., Edward R.
Browning Co., The.
Buckeye Traction Ditcher Co.
Young Machy. Co., A. L.

**DRAGLINE EXCAVATORS**
Fulton Engine Works.
Meese & Gottfried Company.
Osgood Co., The.

**DREDGES, DIPPER**
Yuba Construction Co., The.

**DREDGING MACHINERY**
Osgood Co., The.

**ELECTRICAL MACHINERY**
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

**ENGINES, DIESEL, AND OIL**
Allis-Chalmers Mfg. Co.
Moore & Co., Chas. C., Engineers.

**ENGINES, GAS**
Allis-Chalmers Mfg. Co.

**ENGINE-GENERATORS, GASOLINE**
General Electric Co.

**ENGINES, STEAM**
Allis-Chalmers Mfg. Co.
Moore & Co., Chas. C., Engineers.

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California Trojan Powder Co.

**FANS, VENTILATING**
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

**FEED WATER HEATERS**
Platt Iron Works Co.

**FLUMES, IRON**
Corrugated Culvert Companies.

**FLUSHERS, STREET**
Kinney Mfg. Co.

**GASKETS**
(See 'Packing.')

**GAS PRODUCERS**
Pacific Tank & Pipe Co.

**GEARS**
General Electric Co.
Meese & Gottfried Company.

**GEARS, SILENT**
General Electric Co.

**GENERATORS, ELECTRIC**
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

**GIANTS**
Pelton Water Wheel Co., The.

**GRADERS**
Austin-Western Road Machy. Co.
Good Roads Machy. Co., Inc., The.
Kilbourne & Jacobs Mfg. Co.

**GRAVEL, CONCRETE MIX**
Grant Gravel Co.
Grant Rock & Gravel Co.
Worswick Street Paving Co.

**HEATERS**
Platt Iron Works Co.

**HOISTING MACHINERY**
Austin-Western Road Machy. Co.
Bacon & Co., Edward R.
Browning Co., The.

**HOSE, AIR, STEAM AND WATER**
N. Y. Belting & Packing Co.

**HOSE, SUCTION**
N. Y. Belting & Packing Co.

**HYDRANTS**
Western Pipe & Steel Co.

**HYDRAULIC SUPPLIES**
American Well Works.
Corrugated Culvert Companies.
Jackson Iron Works, Byron.
Platt Iron Works Co.
Sacramento Pipe Works.
Western Pipe & Steel Co.

**INSURANCE, COMPENSATION**
Aetna Accident & Liability Co.

**LAMPS, ARC AND INCANDESCENT**
General Electric Co.
Westinghouse Electric & Mfg. Co.

**LOCOMOTIVES, ELECTRIC**
General Electric Co.
Westinghouse Electric & Mfg. Co.

**LOCOMOTIVE CRANES, STEAM**
Browning Co., The.

**METERS, BOILER FEED WATER**
Builders' Iron Foundry, The.

**METERS, OIL AND GAS**
Builders' Iron Foundry, The.
General Electric Co.

**METERS, STEAM**
Builders' Iron Foundry, The.
General Electric Co.

**METERS, WATER**
Builders' Iron Foundry, The.
General Electric Co.

**MOTORS**
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

**PACKING**
N. Y. Belting & Packing Co.

**PAVERS**
Smith Co., T. L.

**PAVING MATERIALS**
Cowell Lime & Cement Co., Henry.
Grant Gravel Co.
Grant Rock & Gravel Co.
Pacific Portland Cement Co., Con.
Santa Cruz Portland Cement Co.
Standard Oil Co.
Worswick Street Paving Co.

**PIPE, GENUINE IRON WROUGHT**
Woods, Huddart & Gunn.

**PIPE, RIVETED STEEL AND IRON**
Pelton Water Wheel Co., The.
Sacramento Pipe Works.
Western Pipe & Steel Co.
Woods, Huddart & Gunn.

**PIPE SPECIALS**
Builders' Iron Foundry, The.

**PIPE, WOOD**
Pacific Tank & Pipe Co.

**PNEUMATIC HOSE**
N. Y. Belting & Packing Co.

**POWDER**
Cal. Trojan Powder Co.

**POWER PLANTS**
Allis-Chalmers Mfg. Co.
General Electric Co.
Moore & Co., Chas. C., Engineers.
Westinghouse Electric & Mfg. Co.

**PULLEYS, SHAFTING AND HANGERS**
(See 'Transmission Machy.')

**PULVERIZERS**
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Chalmers & Williams.

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Allis-Chalmers Mfg. Co.
American Well Works.
Jackson Iron Works, Byron.
Kinney Manufacturing Co.
Moore & Co., Chas. C., Engineers.
Platt Iron Works Co.
Yuba Construction Co., The.

**RAILINGS, PIPE**
Sacramento Pipe Works.

**RAILWAY SUPPLIES AND EQUIPMENT**
Harron, Rickard & McCone.

**RENTING MACHINERY**
Beard T. K.
Enterprise Electric Works.
Sherbesman, J. P.

**ROAD OILS**
Standard Oil Co.

**ROAD MACHINERY**
Austin-Western Road Machy. Co.
Bacon & Co., Edward R.
Browning Co., The.
Good Roads Machy. Co., Inc., The.
Kinney Manufacturing Co.
Smith Co., T. L.
Waterloo Cement Machy. Corp.
Young Machy. Co., A. L.
Yuba Construction Co., The.

**ROAD ROLLERS**
Austin-Western Road Machy. Co.
Bacon & Co., Edward R.
Erie Machine Shops.
Good Roads Machy. Co., Inc., The.
Young Machy. Co., A. L.

**ROCK CRUSHERS, DISC OR JAW**
Good Roads Machy. Co., Inc., The.

**ROCK, ORE, AND GRAVEL HANDLING MACHINERY**
Good Roads Machy. Co., Inc., The.

**ROLLS, CRUSHING**
Meese & Gottfried Company.

**ROPE, MANILA AND JUTE**
Meese & Gottfried Company.

**ROPE, WIRE**
Roebling's Sons Co., John A.

**RUBBER GOODS**
N. Y. Belting & Packing Co.

**SAFETY APPLIANCES**
General Electric Co.

**SAW MILL MACHINERY**
Meese & Gottfried Company.

**SCREENS**
Allis-Chalmers Mfg. Co.
Good Roads Machy. Co., Inc., The.
Meese & Gottfried Company.
Roebling's Sons Co., John A.

**SECOND-HAND EQUIPMENT**
See Opportunity Page.

**SEWER DITCHING MACHINES**
Austin-Western Road Machy. Co.
Bacon & Co., Edward R.
Buckeye Traction Ditcher Co.
Ware, R. F.
Young Machy. Co., A. L.

**SEWER PIPE**
Corrugated Culvert Companies.
Pacific Tank & Pipe Co.

**SHAFTING**
(See 'Transmission Machy.')

**SHOES AND DIES**
Harron, Rickard & McCone.

**SHOVELS, STEAM**
Osgood Co., The.

**SPRINKLERS, STREET**
Kinney Manufacturing Co.
Tiffin Wagon Co., The.

**SUCTION DREDGES**
Osgood Co., The.
Yuba Construction Co., The.

**TAMPERS, POWER**
Bacon & Co., Edward R.

**TANKS, WOOD**
Pacific Tank & Pipe Co.

**TRACTORS**
Allis-Chalmers Mfg. Co.
Yuba Construction Co., The.

**TRAMWAYS, AERIAL**
Roebling's Sons Co., John A.

**TRANSMISSION MACHINERY**
Allis-Chalmers Mfg. Co.
Platt Iron Works Co.

**TURBINES, HYDRAULIC**
Allis-Chalmers Mfg. Co.
Pelton Water Wheel Co., The.
Platt Iron Works Co.

**TURBINES, STEAM**
Allis-Chalmers Mfg. Co.
General Electric Co.
Moore & Co., Chas. C., Engineers.
Westinghouse Electric & Mfg. Co.

**VALVES**
Western Pipe & Steel Co.

**VENTURI METERE AND TUBES**
Builders Iron Foundry, The.

**WAGONS, DUMP**
Austin-Western Road Machy. Co.
Bacon & Co., Edward R.
Good Roads Machy. Co., Inc., The.
Tiffin Wagon Co.
Troy Wagon Works.

**WATER MAINS**
Corrugated Culvert Companies.
Pacific Tank & Pipe Co.
Sacramento Pipe Works
Western Pipe & Steel Co.

**WATER WHEELS**
Allis-Chalmers Mfg. Co.
Moore & Co., Chas. C., Engineers.
Pelton Water Wheel Co., The.
Platt Iron Works Co.

**WELDING OUTFITS**
General Electric Co.

**WELL DRILLING MACHINERY AND SUPPLIES**
Harron, Rickard & McCone.

**WIRE CABLES**
Roebling's Sons Co., John A.

**WIRE CLOTH**
Roebling's Sons Co., John A.

**WIRE, INSULATED**
General Electric Co.
Meese & Gottfried Company.
Roebling's Sons Co., John A.
Westinghouse Electric & Mfg. Co.

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The Manufacturers and Selling Agents listed above can furnish a full line of dependable Contractors' Machinery, Supplies, and Instruments. They are ready to serve you with guaranteed products and "after-sale" personal attention.

You may, however, be looking for equipment that is not listed here. Then call on WESTERN ENGINEERING direct. We have the catalogs and the data of most manufacturers and will gladly give you full information, addresses of agents, etc.

Just let us know what you are looking for and we will get it for you or put you in touch with the local representatives. There is no charge for this service. It is part of our service to you.

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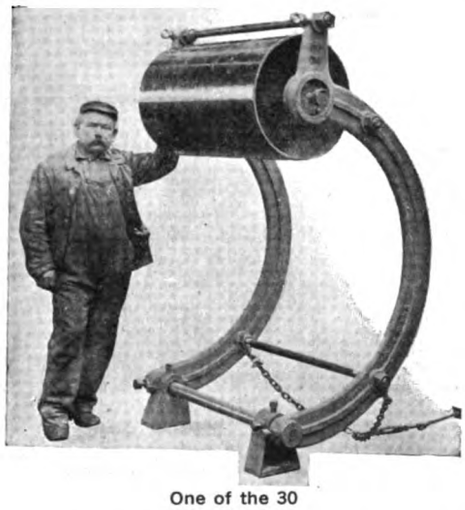
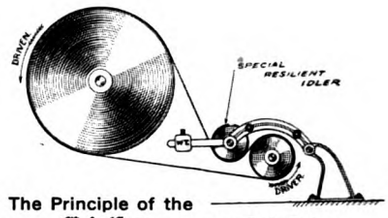


One of the 30

## An order for 30 large M & G Shortcenter Belt Drives




The Principle of the M & G Shortcenter Belt Drive

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*Better talk it over with our engineers.*

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*Engineers and Manufacturers*

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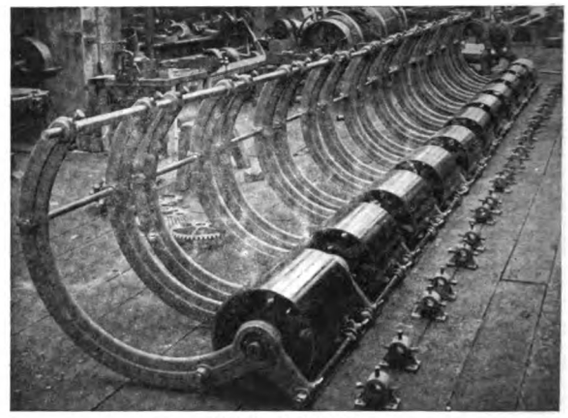

Eleven of the 30


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*Friends and Customers*

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*and*

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